

Claims

We Claim:

1. An apparatus for removing suspended matter from a liquid, comprising:
 - a) a vessel for receiving a flow of liquid having suspended matter therein;
 - b) a plurality of partitions sequentially dividing the vessel into an inlet chamber, at least a first gasification chamber and a second gasification chamber, and an outlet chamber, each adjacent chamber fluidly communicating with one another;
 - c) a discharge chamber having a fluid communication with the outlet chamber;
 - d) an inlet to introduce the flow of liquid into the inlet chamber;
 - e) a mechanism for ingesting and mixing gas into the liquid of each gasification chamber for creating a turbulent area and for attracting the suspended matter and for carrying the suspended matter to an upper portion of the vessel; the interface of the gas and liquid being a liquid level;
 - f) a primary skim collection channel extending at least partially along the top of the partition between the first gasification chamber and the second gasification chamber for collecting suspended matter in the upper portion of both gasification chambers;
 - g) a controller for regulating the height of the liquid level in response to the movement of the vessel; and
 - h) an outlet for removing clarified liquid from the discharge chamber.
2. The apparatus of claim 1 further comprising a control mechanism for controlling the liquid level in the first and second gasification chambers by regulating flow through a valve in the fluid communication between the outlet chamber and the discharge chamber.
3. The apparatus of claim 1 further comprising a control mechanism for controlling the liquid level in the discharge chamber by regulating flow through a valve in the outlet from the discharge chamber.
4. The apparatus of claim 1 further comprising:

- j) at least one baffle near the primary skim collection channel to dampen motion of the liquid caused by movement of the vessel.
5. The apparatus of claim 4 where the vessel has a horizontal plane and where the baffle j) extends inwardly into the vessel from an interior top surface thereof to a lowermost distal edge, where a line between an upper edge of the primary skim collection channel and the distal edge of the baffle j) forms an angle with the horizontal plane of between 5 and 15°.
- 1 6. An apparatus for removing suspended matter from a liquid, comprising:
2 a) a vessel for receiving a flow of liquid having suspended matter therein;
3 b) a plurality of partitions sequentially dividing the vessel into an inlet chamber, at
4 least a first gasification chamber and a second gasification chamber, and an outlet
5 chamber, each adjacent chamber fluidly communicating with one another;
6 c) a discharge chamber having a fluid communication with the outlet chamber;
7 d) an inlet to introduce the flow of liquid into the inlet chamber;
8 e) a mechanism for ingesting and mixing gas into the liquid of each gasification
9 chamber for creating a turbulent area and for attracting the suspended matter and
10 for carrying the suspended matter to an upper portion of the vessel, the interface
11 of the gas and liquid being a liquid level;
12 f) a primary skim collection channel extending at least partially along the top of the
13 partition between the first gasification chamber and the second gasification
14 chamber for collecting suspended matter in the upper portion of both gasification
15 chambers;
16 g) a secondary skim collection channel, independent of the primary channel, located
17 in the upper portion of the inlet chamber;
18 h) a tertiary skim collection channel, independent of the primary and secondary
19 channels, located in the upper portion of the discharge chamber;
20 i) an outlet for removing clarified liquid from the discharge chamber;
21 j) at least one baffle near the primary skim collection channel to dampen motion of
22 the liquid caused by movement of the vessel; and

- 23 k) a control mechanism for controlling height of the liquid level in response to the
24 movement of the vessel.
7. The apparatus of claim 6 further comprising a control mechanism for controlling the liquid level in the first and second gasification chambers by regulating flow through a valve in the fluid communication between the outlet chamber and the discharge chamber.
8. The apparatus of claim 6 where the vessel has a horizontal plane and where the baffle j) extends inwardly into the vessel from an interior top surface thereof to a lowermost distal edge, where the line between an upper edge of the primary skim collection channel and the distal edge of the baffle j) forms an angle with the horizontal plane of between 5 and 15°.
- 1 9. A method for clarifying liquid from suspended matter, the method comprising:
2 a) providing a vessel having a plurality of partitions sequentially dividing the vessel
3 into an inlet chamber, at least a first gasification chamber and a second
4 gasification chamber, and an outlet chamber, each adjacent chamber fluidly
5 communicating with one another, and a discharge chamber in fluid
6 communication with the outlet chamber;
7 b) introducing a flow of liquid having suspended matter into the inlet chamber
8 through an inlet;
9 c) introducing a flow of gas into each of the first and the second gasification
10 chambers for creating a turbulent area, and for allowing the gas to attract the
11 suspended matter and carry it to an upper portion of the vessel, the interface of
12 the gas and liquid being a liquid level;
13 d) maintaining the liquid level below a primary skim collection channel extending at
14 least partially along the top of the partition between the first gasification chamber
15 and the second gasification chamber
16 e) intermittently raising the liquid level and collecting suspended matter in the
17 primary skim collection channel; and
18 f) removing clarified liquid from the discharge chamber.

10. The method of claim 9 further comprising controlling the liquid level in the first and second gasification chambers by regulating flow through a valve in the fluid communication between the outlet chamber and the discharge chamber.
11. The method of claim 9 further comprising controlling the liquid level in response to the movement of the vessel.
12. The method of claim 9 further comprising controlling the liquid level in response to the pitch or roll of the vessel.
13. The method of claim 9 further comprising controlling the liquid level in the discharge chamber by regulating flow through a valve in an outlet from the discharge chamber.
14. The method of claim 9 further comprising:
 - g) dampening the motion of the liquid near the primary skim collection channel with at least one baffle.
15. The method of claim 14 where g) dampening the motion of the liquid near the primary skim collection channel is accomplished with at least one baffle extending inwardly into the vessel from an interior top surface thereof, the baffle having a lowermost distal edge, where a line between an upper edge of the primary skim collection channel and the distal edge of the baffle, forms an angle with a horizontal plane of the vessel of between 5 and 15°.
16. The method of claim 9 where the residence time for each gasification chamber is between 2.0 and 2.5 minutes.
17. The method of claim 9 further comprising collecting suspended matter in a secondary skim collection channel, independent of the primary channel, located in

the upper portion of the inlet chamber.

18. The method of claim 17 further comprising collecting suspended matter in a tertiary skim collection channel, independent of the primary and secondary channels, located in the upper portion of the discharge chamber.